

**ELEVATION OF *DIABROTICA SICUANICA*
(COLEOPTERA: CHRYSOMELIDAE) TO THE
SPECIES LEVEL WITH NOTES ON THE
ALTITUDINAL DISTRIBUTION OF *DIABROTICA*
SPECIES IN THE CUZCO DEPARTMENT OF PERU^{1,2}**

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ABSTRACT: *Diabrotica decempunctata sicuanica* Bechyne is elevated to the species level. The altitudinal distribution of 17 species of *Diabrotica* in the Cuzco Dept. of Peru, based on material collected in January of 1979 and 1982, is presented. The greatest diversity of species (11) was collected in the altitudinal range of 1250 to 2450 M. At elevations below 2800 M, most beetles were found on flowers of cucurbits. In the altitude zone from 2800 to 3500 M, two taxa were collected, both from *Zea mays* L.: *D. speciosa vigens* Erichson, from 2800 to 3200 M and *D. sicuanica* Bechyne, from 3000 to 3500 M elevation. The two species with the most extensive continental ranges were collected over the greatest range of altitudes.

Diabrotica is a largely Neotropical genus that includes several species of great economic importance in North America, particularly as pests of maize. Given the pest status, the South American members of the genus have been of interest to North American entomologists as, for example, reservoirs of natural enemies. Despite this interest, most South American *Diabrotica* are very poorly known. Except for a few widespread economic pests, the literature consists of original descriptions and catalog entries. Distribution records are scanty and indefinite. Given the nature of Andean ecology, altitudinal distribution patterns are expected, but no such information is available for *Diabrotica*.

In the course of a total of nearly 7 weeks of searches for natural enemies in the Cuzco Department of Peru in January of 1979 and 1982, we made extensive collections of *Diabrotica*. Based on these collections, we herein elevate one taxon, *D. decempunctata sicuanica* Bechyne, to the species level, and report on the altitudinal distribution of 17 taxa of *Diabrotica*.

¹Received October 10, 1983. Accepted March 3, 1984.

²Purchased by Science & Education Administration, V.S.D.A., for official use.

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Taxonomic Status of *Diabrotica decempunctata sicuanica* Bechyne

Our experience indicates a status change for this taxon is appropriate despite our commitment to the ideal that piecemeal changes separate from a major revision can be detrimental. We have recognized *D. d. sicuanica* as a pest of maize (see below), so a literature might develop which makes nomenclatural simplicity and stability highly desirable. Taxonomic information indicates species status is appropriate, and because trinomials are commonly ignored in general entomological literature, we elevate *D. d. sicuanica* to the species level. A brief description is given here because the original description is limited to a key couplet.

Diabrotica sicuanica Bechyne new status

D. decempunctata sicuanica Bechyne, 1958: 555.

Description. Body elongate oval, lime green nearly throughout, elytra widest slightly post-medially. Length 5 to 7 mm.

Pronotum. Shiny lime green, wider than long, mean ratio length to width, 0.70; disc with 2 foveae tiny or absent, glabrous except for a prominent seta on anterior and posterior angles and 1 or 2 short setae on the lateral margin adjacent to the prominent seta; lateral margin distinct, reflexed; scutellum piceous.

Elytra. Humeral plicae absent, disc asculate, finely, irregularly punctate, surface very finely alutaceous; each elytron with 2 spectrum orange (frequently faded) diffuse spots, one originating on humerus and narrowing apicad, ending at basal one-third to one-half of elytron, other oblong, one-third width of elytron, originating at apical one-third of elytron, one-third of elytral width of suture, directed diagonally towards apical curve. Piceous maculation highly variable; piceous sutural vitta at basal one-sixth of elytron and at most 5 spots on each elytron: 1 humeral; 2 in proximal one-half, 1 on disc near but not touching suture, the other nearer lateral margin lying slightly apicad from the first, 2 arranged similarly in posterior one-third. Piceous maculation may be reduced to a very narrow sutural vitta; distal medial spots are the last to disappear, except occasionally only humeral spots present; when present, the distal spots lie at either end of distal orange spot. Disc essentially glabrous; a few setae on apical margin.

Head. Very shiny, entirely piceous. Antennae entirely piceous, three-fourths length of body in male, two-thirds length of body in female; third segment $1\frac{1}{4}$ times length of segment 2; segments 2 and 3 together two-thirds length of segment 4.

Ventral side. Prothorax yellow or lime green, meso and metathorax entirely piceous, all legs entirely piceous, abdomen yellow or lime green.

Male genitalia. The internal sac is illustrated in Figure 1a.

Material Examined. Three hundred and thirteen (313) specimens from the localities listed in Table 1 collected by J. Krysan and T. Branson, January 1982, and deposited in USNM and Ministerio de Agricultura y Alimentacion, Lima, Peru; San Jeronimo, Cuzco Dept., Peru III-24-79, G. Buckingham, private colln.; AUTOTYPE, Urabamba, Peru V-16-62, 3200 M, Carrasco, obtained from Dr. F. Carrasco, Cuzco Dept., Peru (to be deposited in USNM).

Distribution. In addition to the material examined, we know of specimens collected at Cuzco, Peru, 3500 M, by G. Mollada, X-15-61 in California Insect Survey and the type material collected at Sicuani, Peru (Museum G. Frey). Thus, the species has been collected only in the Cuzco Dept. of Peru and from localities above 3150 M elevation.

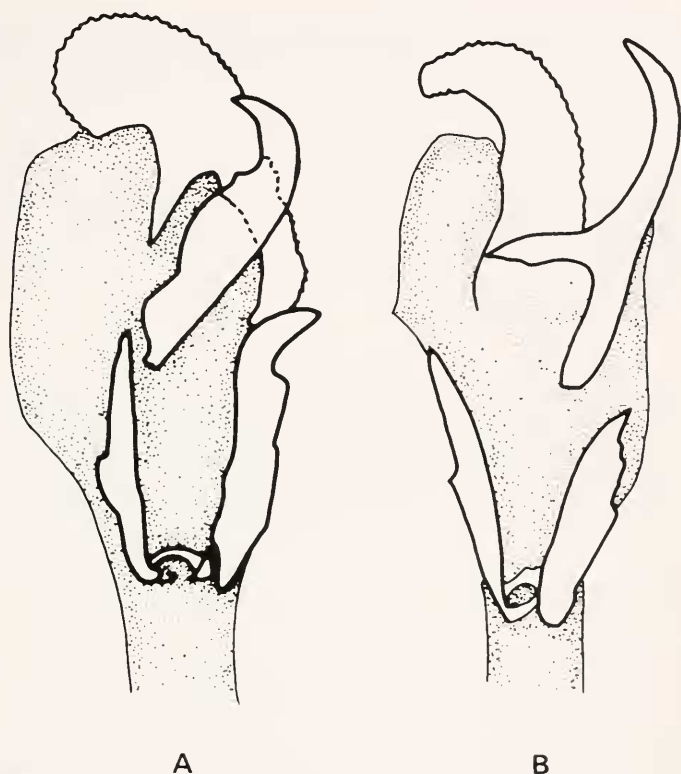


Fig. 1. Internal sac structure of *D. sicuanica* (A) and *D. d. semiviridis* (B).

Taxonomic Discussion. Bechyne (1958) named *D. sicuanica* as a subspecies of *D. decempunctata* Latreille in a key. In that key, he also combined *D. semiviridis* Bowditch as a subspecies of *D. decempunctata*. We collected both *D. d. semiviridis* and *D. sicuanica* in the Cuzco Dept., but their ranges are altitudinally distinct; the former was collected at 1800-2500 M and the latter only above 3150 M (see next section). Usually subspecies rank indicates morphological similarity, so at least some specimens should be hard to place. That is not so with these taxa. Size of elytral punctations, Bechyne's diagnostic character for these taxa, is technically a quantitative trait and hence potentially variable, but we have seen no beetles with intermediate punctuation size, and Bechyne mentioned none. We consider the internal sac of the male genitalia to bear the most useful characters for distinguishing *Diabrotica*, so we illustrate here the

armature of internal sacs of *D. sicuanica* and *D. d. semiviridis* (Figs. 1a and 1b). The differences are obvious and should be taken into account by the next revisor; the important point for now is the relationship between *D. sicuanica* and the nominate taxon *D. decempunctata* Latreille. The type of the latter is a damaged female specimen without exact locality data. The pronotal shapes of *D. sicuanica* and the type of *D. decempunctata* Latreille are obviously different, a difference which can be measured. Of 33 female *D. sicuanica* measured, the length to width ratio of the pronotum (mean 0.70, range 0.66 to 0.74) is clearly different than that of the type of the nominate subspecies (0.78).

Collection Sites and Methods

The climate and ecology of Peru is summarized in Gorbman et al. (1961), and we use their designations for ecological regions. The collections above 2500 M are in the Quechua region. Sites between 1000 and 2500 M in the Valle Lares, and the valleys of the Rio Urubamba and Rio Pilcopata, are in the Fluvial Yunga. The collections between 400 and 1000 M are in the Selva Alta, and those below 400 M are in the Selva Baha. The collection sites near Limatambo and Curahuasi in the Rio Apurimac system, while classified in the Quechua, are considerably drier than the other sites in this biological zone.

In most localities, all plants found in flower were examined for beetles on the foliage as well as the floral parts. The great majority of beetles (exceptions are noted) were collected from the flowers or foliage of domestic or wild cucurbits. Collections in the Selva Baha and Selva Alta were from highly diverse vegetation systems, and few beetles were found. Only a total of four days was spent searching at those elevations. Collections in the Fluvial Yunga were usually from tiny garden plots invariably containing domestic cucurbits and sometimes containing corn. From these complex systems in the Selva and Fluvial regions, numbers of beetles collected would mean little.

Collections in the upper elevations (> 2800 M) of the Quechua region, however, were always from row-crop agricultural land or alfalfa monocultures. In maize fields in these upper elevations we saw evidence of altitudinal change in species composition so we conducted a rather intensive search. This search focused on the Urcos, Sacred, Ccorao, and Cuyo Grande valleys and the valley of the Rio Colorado. The Cuyo Grande valley is above, but contiguous with, the Sacred Valley proper and it was fortuitous that we could collect where maize production was continuous between the two valleys. Twenty-seven fields were searched for a minimum of 30 minutes each. Longer search numbers were adjusted to reflect 30 minutes of search. We think those numbers reflect the elevational relation-

ship between *D. sicuanica* and *D. speciosa vigens*.

The beetles will be deposited in the USNM and the collection of the Ministerio de Agricultura y Alimentacion, Lima, Peru.

RESULTS

Elevation of Collections

The species collected at the various sites summarized by elevation levels are presented in Table 1. In the Selva Alta and Selva Baha, 5 species were found, but each was represented in very low numbers. The greatest variety of species (11) was encountered in the Fluvial Yunga where we collected at elevations from 1250 to 2450 M. All these beetles were collected from cucurbit flowers.

In the Quechua region from elevation 2600 M to 3000 M, *D. speciosa vigens* was by far the most common species found. It was collected from maize, cucurbits, common bean (*Phaseolus vulgaris*) foliage and flowers, alfalfa foliage and flowers, and flowers of the weedy legume *Spartium junceum*. The one other species (new species, *virgifera* group) collected in this elevation range was represented by a series of 31 ♂ beetles found near Limatambo at 2800 M.

Above 2800 M elevation we found two species, *D. s. vigens* and *D. sicuanaca* (Table 2). In the elevation range from 3000 to 3200 M, *D. s. vigens* occurred with *D. sicuanaca*; we never collected the latter taxon at lower elevations. Above 3200 M, *D. sicuanica* was the only species of *Diabrotica* collected. The highest elevation at which we collected *D. sicuanica* was 3500 M (Table 2). In the Valley of the Rio Colorado, where we collected from 2800 to 3500 M, we did not find *D. sicuanica*, but we did find *D. speciosa vigens* up to 3200 M elevation. Incidentally, the Urcos and Anta valleys, where only *D. sicuanica* was collected, have no accessible openings to valleys at lower elevations comparable to the intersection of the Cuyo Grande and Sacred valleys.

Despite the polycultural nature of many of the fields, we found *D. sicuanica* beetles only on maize plants. Furthermore, larvae of *D. sicuanica* were found feeding on maize roots.

DISCUSSION

These collections were made at the peak of the growing season; e.g., in the Quechuan region, maize was silking and legumes were commonly in flower. Therefore, they make a first approximation of the altitudinal distribution of *Diabrotica* in the southern Andes of Peru.

Some patterns can be detected among the collections. Several of the

taxa with restricted elevational distribution have been recorded only from Peru.

Two species, *D. s. vigens* and *D. viridula*, were distinctive in that we collected them over a much greater range of altitudes than any of the other species. This great altitudinal range in this small area of the Andes is consistent with the fact that these two species have the most widespread geographical distributions of any *Diabrotica*. *Diabrotica speciosa* (sensu lato) range from Columbia and Brazil to Argentina and Bolivia (Smith and Krysan, unpublished). The range of *D. viridula* extends from Mexico and Brazil to Chile (Wilcox, 1972) and the Easter Island (Olalquiaga, 1980).

Our first collections above 2800 M suggested a change in species composition in a rather narrow altitudinal zone. The two species of *Diabrotica* in that zone were found in association with maize in row-crop agricultural plots, a relatively uniform ecosystem amenable to a systematic search. We have tabulated here (Table 2) the numbers of beetles collected in our rather unrefined survey in preference to simply listing localities to better record our basis for concluding that *D. sicuanica* occurs at elevations above the wide-ranging species, *D. s. vigens*. Ecological characteristics that

Table 1. Species collected at various sites summarized by elevation levels.

	Localities and elevation ranges (in meters) ^{1/}									
	1250- <900	1400	1830	1900- 2000	2100- 2100	2100- 2200	2450	2800- 2980	3000- 3200	3350- 3500
<i>D. sicuanica</i> Bechyne									12	13
<i>D. new sp. (virgifera group)</i> ^{2/}								10		
<i>D. nigromaculata</i> Jacoby			4							
<i>D. tumidicornis</i> Erichson			4	5	6					
<i>D. mauliki</i> Barber			4							
<i>D. sharpi usualis</i> Bechyne			4	5	6					
<i>D. decempunctata semiviridis</i> Bowditch			4	5	6	7	8			
<i>D. mapiriensis</i> new ssp. ^{2/}			4	5	6		8			
<i>D. speciosa vigens</i> Erichson		3	4	5	6		8	9,10,11	12	
<i>D. viridula</i> Fabricius	1	3	4	5	6					
Unknown species #1		3								
<i>D. peruensis</i> Bowditch		3								
<i>D. limitata quindecimpunctata</i> Germar		3								
<i>D. septemliturata</i> Erichson		1								
Unknown species #2		2								
<i>D. gracilentata</i> Erichson		1								
Unknown species #3 (near <i>D. godmani</i> Jacoby)		1								

^{1/}1 = Quince Mil; 2 = Pilcopata; 3 = road near Chaullay; 4 = Macchu Picchu; 5 = 50 km south Quillabamba; 6 = Lares Valley, 75 km north Calca; 7 = 140 km post, road to Pilcopata; 8 = 70 km south Quillabamba; 9 = Ollantaytambo; 10 = Limatambo; 11 = Curahuasi; 12 = Pisac and lower Cuyo Grande; 13 = Andahuaylillas (Urcos Valley), Cuyo Grande Valley, Pucyura (Anta Valley), Ccorao (on road from Cuzco to Pisac).

^{2/}These new taxa will be described in a revision of the *virgifera* group now being completed.

obviously change through this zone and could bear on species distributions are temperature, plant composition of the fields, and edaphic factors related to slope. The Sacred Valley is a flat floodplain, intensively cropped, largely in maize monoculture. By contrast, the Cuyo Grande Valley is very steep and characteristically has small, sloped fields where polycultures are the rule but maize clearly dominates. The Cuyo Grande opens onto the Sacred Valley at 3000 M elevation. Both species were found in floodplain and sloped fields so slope alone is probably not a factor. Also, we found beetles of both *D. sicuanica* and *D. s. vigens* in both maize monoculture and polycultural fields so the admixture of forbs so common in maize fields in the Cuyo Grande Valley is not a likely explanation for the elevation-related changes in species composition.

Given the larval and adult associations, we conclude that *D. sicuanica* is a pest of maize restricted to high Andean elevations. Indeed, in the Cuyo Grande, Ccorao, Urcos, and Anta Valleys, we found *D. sicuanica* at the highest elevations at which we found maize.

Table 2. Numbers of *D. speciosa vigens* and *D. sicuanica* collected at elevations of 2800 M and higher.

Location	Elev. (M)	<i>D. speciosa vigens</i>	<i>D. sicuanica</i>	Culture
Sacred Valley (SV) and Contiguous Valleys				
Ollantaytambo (SV)	2800	20	0	maize
Urubamba (SV)	2920	212	0	maize
Yucay (SV)	2990	46	0	maize
9 km N. Pisac (SV)	3020	31	13	maize
1 km S. Pisac (SV)	3050	34	158	poly 6
Cuyo Grande Valley	3170	11	18	maize
Cuyo Grande Valley	3200	8	28	poly 2
Cuyo Grande Valley	3350	0	36	poly 5
Ccorao Valley	3470	0	42	poly 1
Ccorao Valley	3500	0	8	poly 4
Adjacent Valleys				
Rio Colorado	3050	60	0	poly 3
Rio Colorado	3140	6	0	maize
Rio Colordao	3200	13	0	maize
Urcos Valley	3500	0	18	maize
Anta Valley	3500	0	43	poly 1

Poly 1 - maize + fava beans

Poly 2 - maize + fava beans + snapbeans + peas

Poly 3 - maize + snapbeans

Poly 4 - maize + fava beans + potatoes

Poly 5 - maize + lupine + snapbeans

Poly 6 - maize + peas (few)

ACKNOWLEDGMENTS

During the 1979 expedition, Dr. R.D. Gordon, USDA, ARS, Washington, D.C., and Arturo Giron, Entomol. Dept. University of Maryland, were very helpful in the practical matters of working in Peru. Mr. Alfonso Arestequi and Dr. Francisco Carrasco, Entomologists, Cuzco, Peru, provided invaluable assistance.

We thank Dr. P. Passerin d'Entreves, Curator, Museo Ed Instituto di Zoologica Sistemática, Università di Torino, Italy, for loan of the type of *Diabrotica decempunctata* and Drs. Ron McGinley and Al Newton, Museum Comparative Zoology, Harvard University, for hospitality extended to JLK while examining types at MCZ.

The 1979 expedition was supported by a cooperative agreement between the Beneficial Insects Introduction Laboratory, USDA, ARS, and the Dept. of Entomology, University of Maryland. The 1982 expedition was supported by the Office of International Cooperation and Development, USDA.

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Y.E.S.

Y.E.S., the YOUNG ENTOMOLOGIST'S SOCIETY, was originally the Teen International Entomology Group which was formed in 1965. Y.E.S. serves as an organization through which members can exchange information about insects through correspondence and group publications. The organization's name reflects its youth orientation, but "young" members of any age are needed for its many activities and functions.

The Societies' publication, Y.E.S. QUARTERLY, is full of "how to" articles, collecting tips, news, field notes, life history information, identification tips, and virtually every other entomological topic, including the non-insect arthropods. Nearly all of the articles are written by the members themselves! In addition, the members tell about themselves and their specific interests via a member directory and the "tradingpost."

Membership in Y.E.S. is open to all individuals, young or old, amateur or professional, with an interest in entomology. There are four membership categories: youth members (up to age 18), collegiate members, adult members and sustaining members. Membership applications and additional information may be obtained from the Department of Entomology, Michigan State University, East Lansing, Michigan 48824-1115.